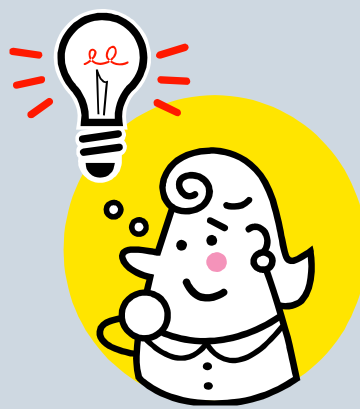
ENSO
& This Winter

Pat Spoden Fall 2010

Paducah, KY

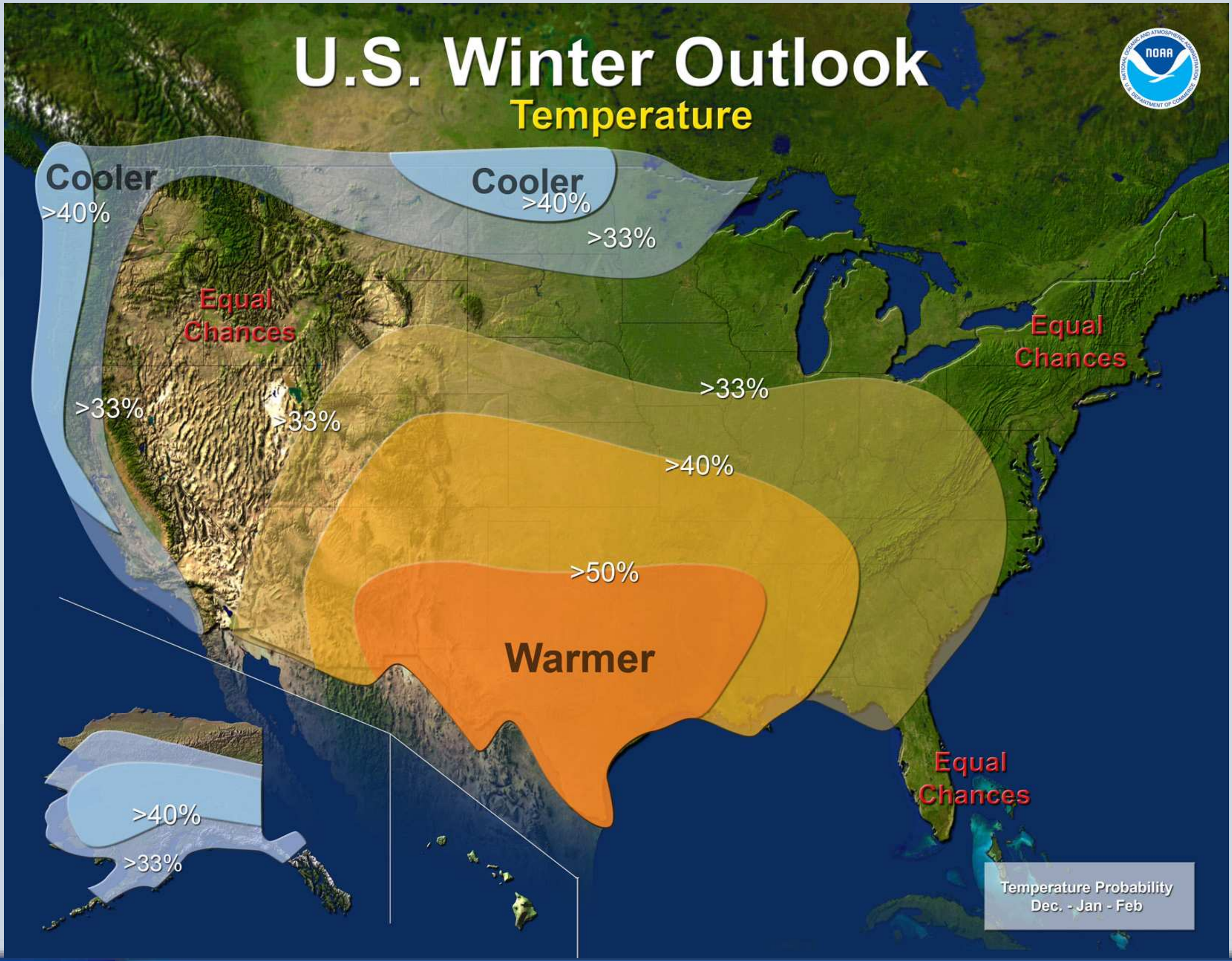
•What is Coming?

- The state of the science does not allow us to forecast where severe weather will occur weeks or months ahead.
- However, by looking at past winters with similar patterns we can get an idea of what might happen.
- Information has been gathered with the help of CPC and SPC

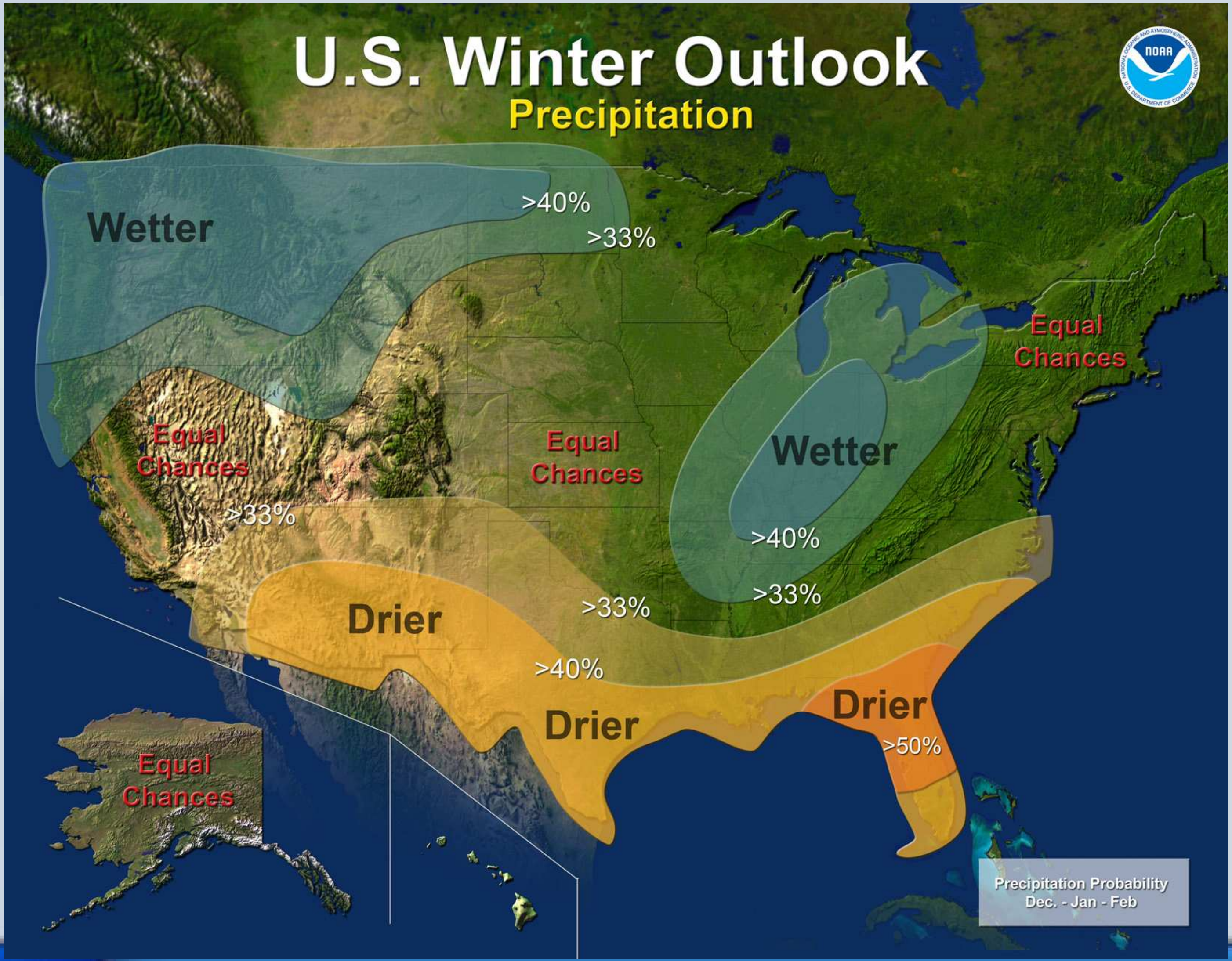


- The opinions expressed are those of the author and not necessarily those of the NWS

•Official Outlooks



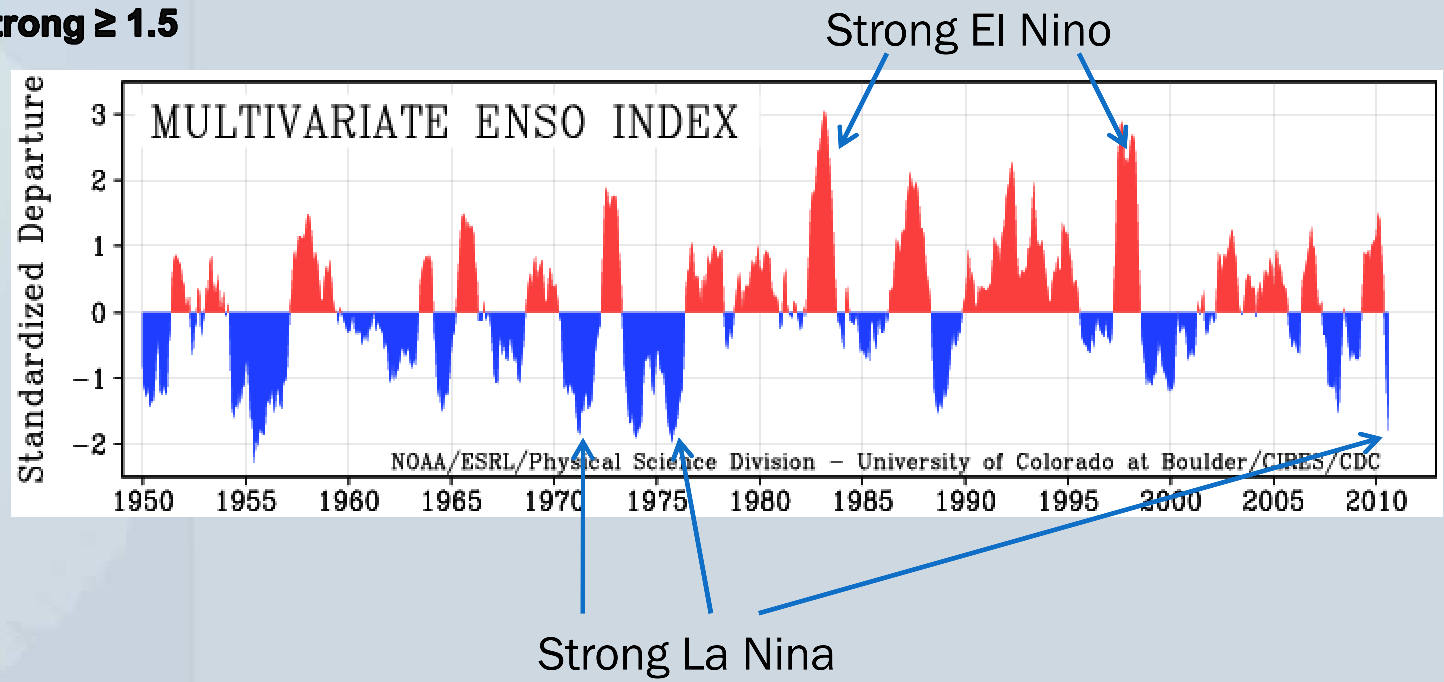
•Official Outlooks



•Current State

(Moderate to Strong La Nina)

- El Nino = 3 consecutive months (average) at or above the +0.5º
- La Nina = 3 consecutive months (average) at or below the -0.5
- Weak = 0.5 to 0.9 SST anomaly
- Moderate = 1.0 to 1.4
- Strong ≥ 1.5



http://ggweather.com/enso/oni.htm

•El Nino Years

- ***Strong*** **= 1957-58, 1965-66, 1972-73, 1982-83, 1987, 1991-92, 1997-98, 2009-10**
- ***Moderate*** **= 1986-87, 1994-95, 2002-03,**
- ***Weak*** **= 1950-51, 1953, 1963-64, 1968-69, 1969-70, 1976-77, 1977-78, 2004-05, 1993, 2006-07**
- **Unknown strength = 1925, 1929, 1930, 1940**

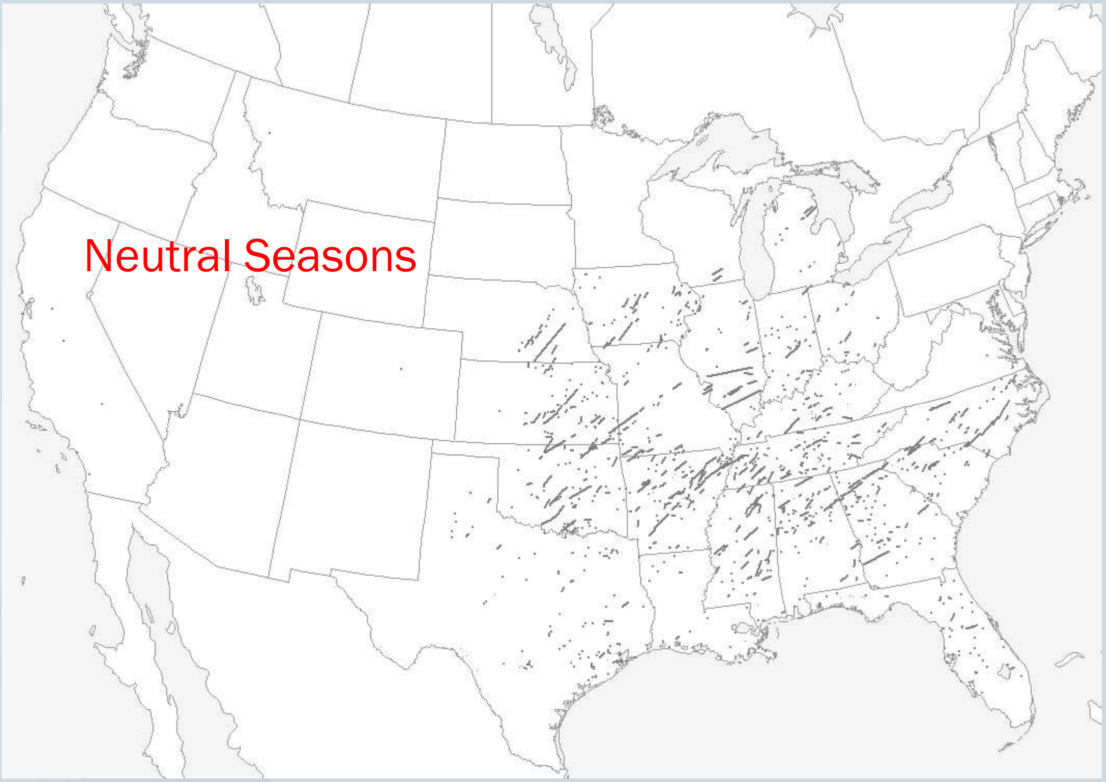
http://www.ems.psu.edu/~nese/elninyr2.htm

http://www.cpc.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml

•La Nina Years

- Strong = 1949-50, 1955-56, 1973-74, 1988-89,
- Moderate = 1954-55, 1964-65, 1970-71, 1975-76, 1998-99, 1999-2000, 2007-08
- Weak = 1950-51, 1957-57, 1961, 1962-63, 1967-68, 1971-72, 1974-75, 1983-84, 1985-85, 1995-96, 2000-01, 2005-06, 2008-09
- Unknown strength = 1933, 1938, 1942, 1944, 1945, 1948

•Tornado Days (6 or more)



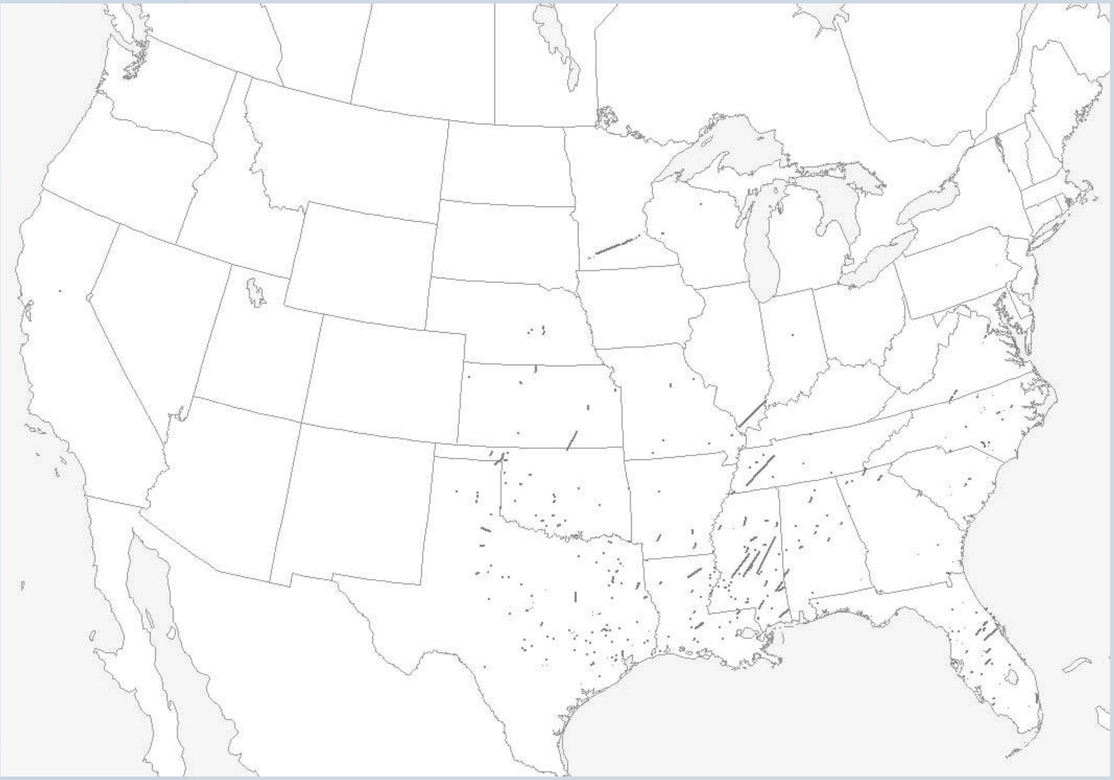
November through February

Through 2006

•Tornado Days

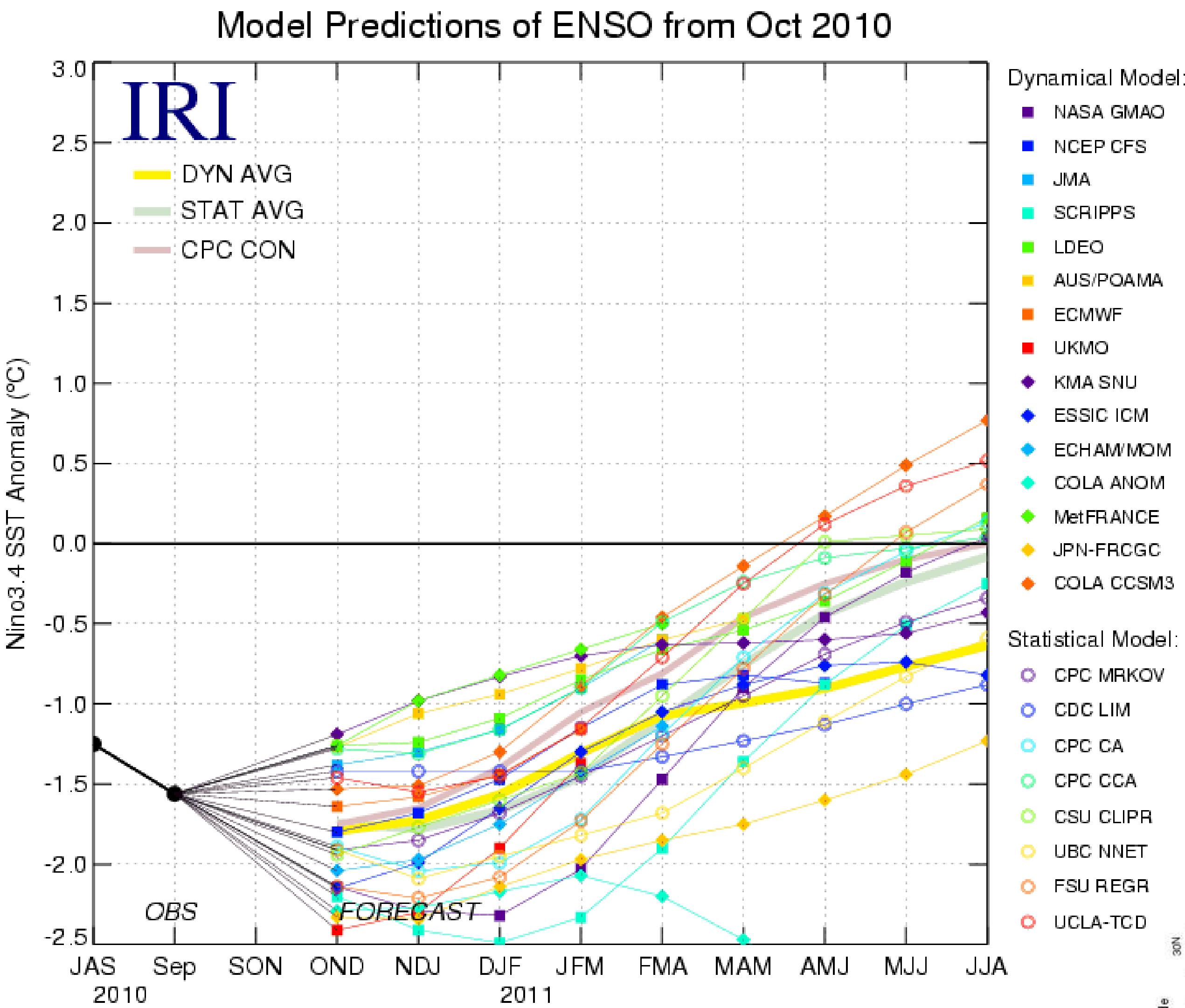
La Nina
Seasons

•Tornado Days

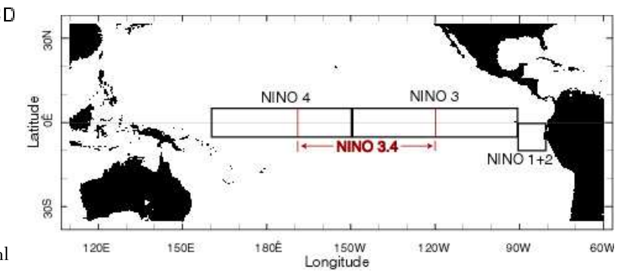


El Nino
Seasons

•This Year's Forecast



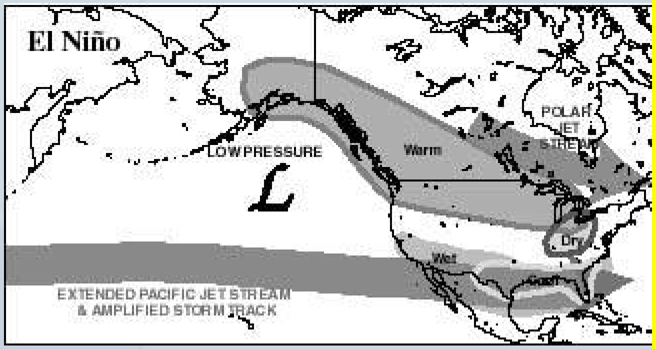
Currently, we are in a moderate to strong La Nina… the fastest growing La Nina on record.

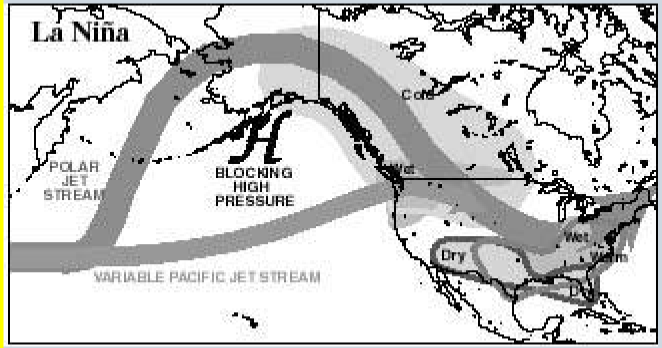


http://iri.columbia.edu/climate/ENSO/background/monitoring.html

•La Nina

- **Historically, during the neutral phase, tornado outbreaks typically occurred from central Oklahoma and Kansas eastward through the Carolinas. *During cold phases, tornado outbreaks have typically occurred in a zone stretching from southeastern Texas northeastward into Illinois, Indiana, and Michigan*. During anomalously warm phases activity was mainly limited to the Gulf Coast States including central Florida.** (THE RELATION OF EL NINO SOUTHERN OSCILLATION (ENSO) TO WINTER TORNADO OUTBREAKS (REVISED VERSION) A. R. Cook and J. T. Schaefer
- **Jan-Mar Season (1950-2003)**





•La Nina's that follow El Nino In the Mid-Mississippi Valley

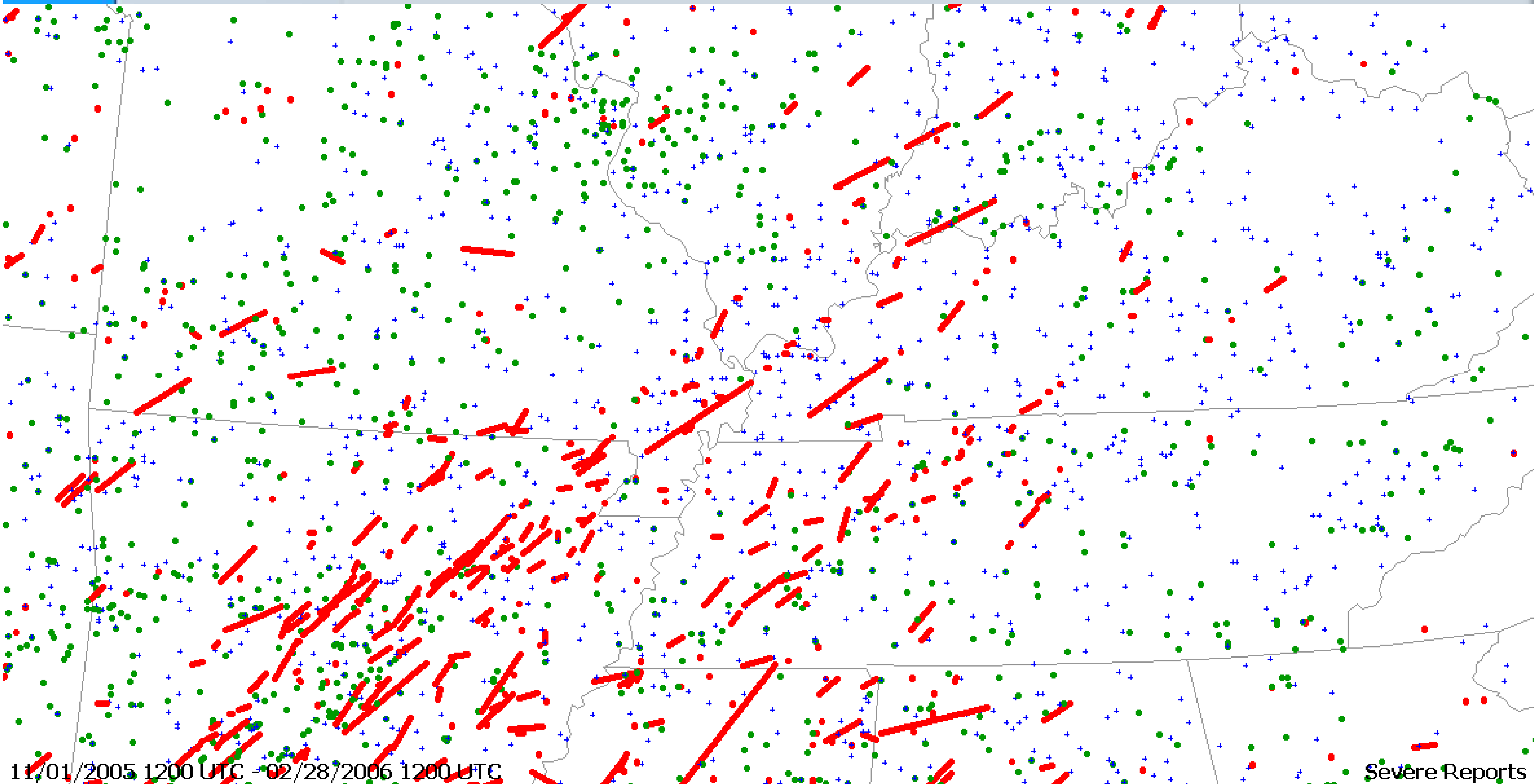
Year	Tornadoes	Hail	Wind	Snow-EVV	Snow-PAH
1964-65	18	7	19	14	9
1970-71	22	5	41	13	8
1973-74	38	16	108	9	3
1983-84	3	30	55	24	7
1988-89	69	46	144	7	5
1995-96	15	109	206	17	11
1998-99	124	394	613	6	8
2005-06	119	413	928	5	8
	408	1020	1558	Ave=12	Ave=7

Corresponding area coverage can be seen on next slide

Does not include 2007-2008 data

Severe weather statistics for November-February

•Severe Weather Plot

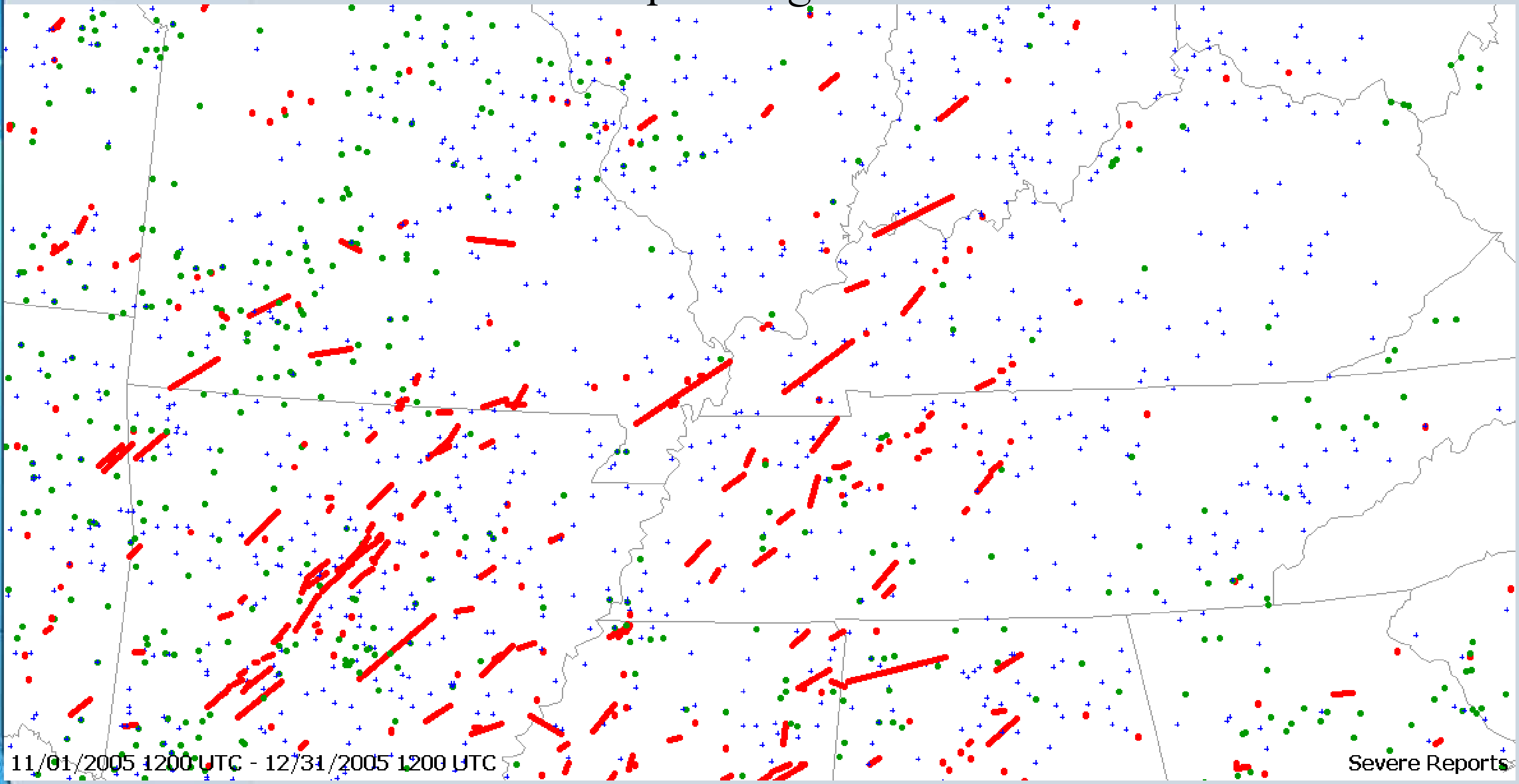


Red= Tor
Blue = Wind
Green = Hail

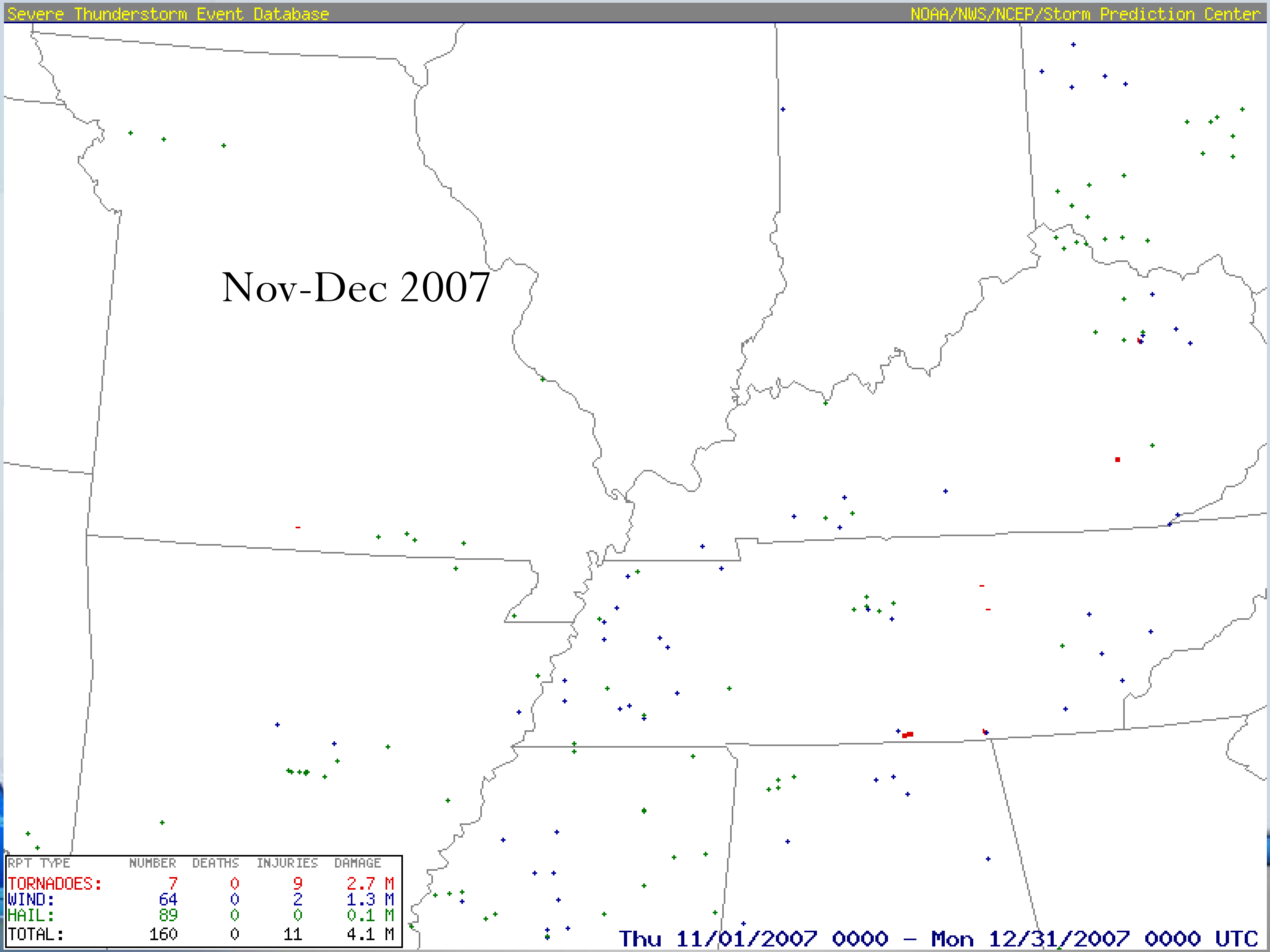
Severe weather plots for November-February

•Nov-Dec Years Similar to 2010

8 Seasons corresponding to slide 13



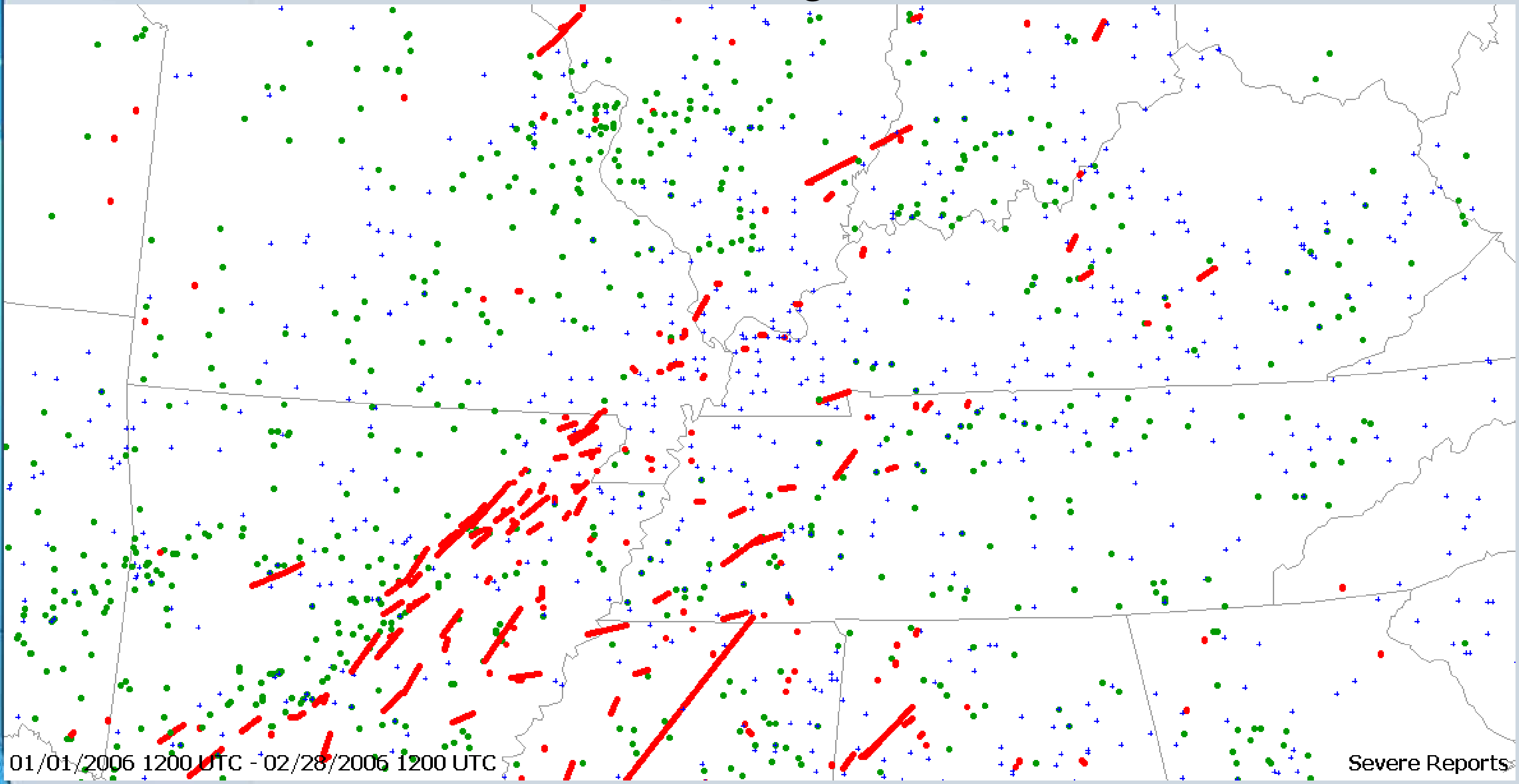
•Nov-Dec Years Similar to 2010



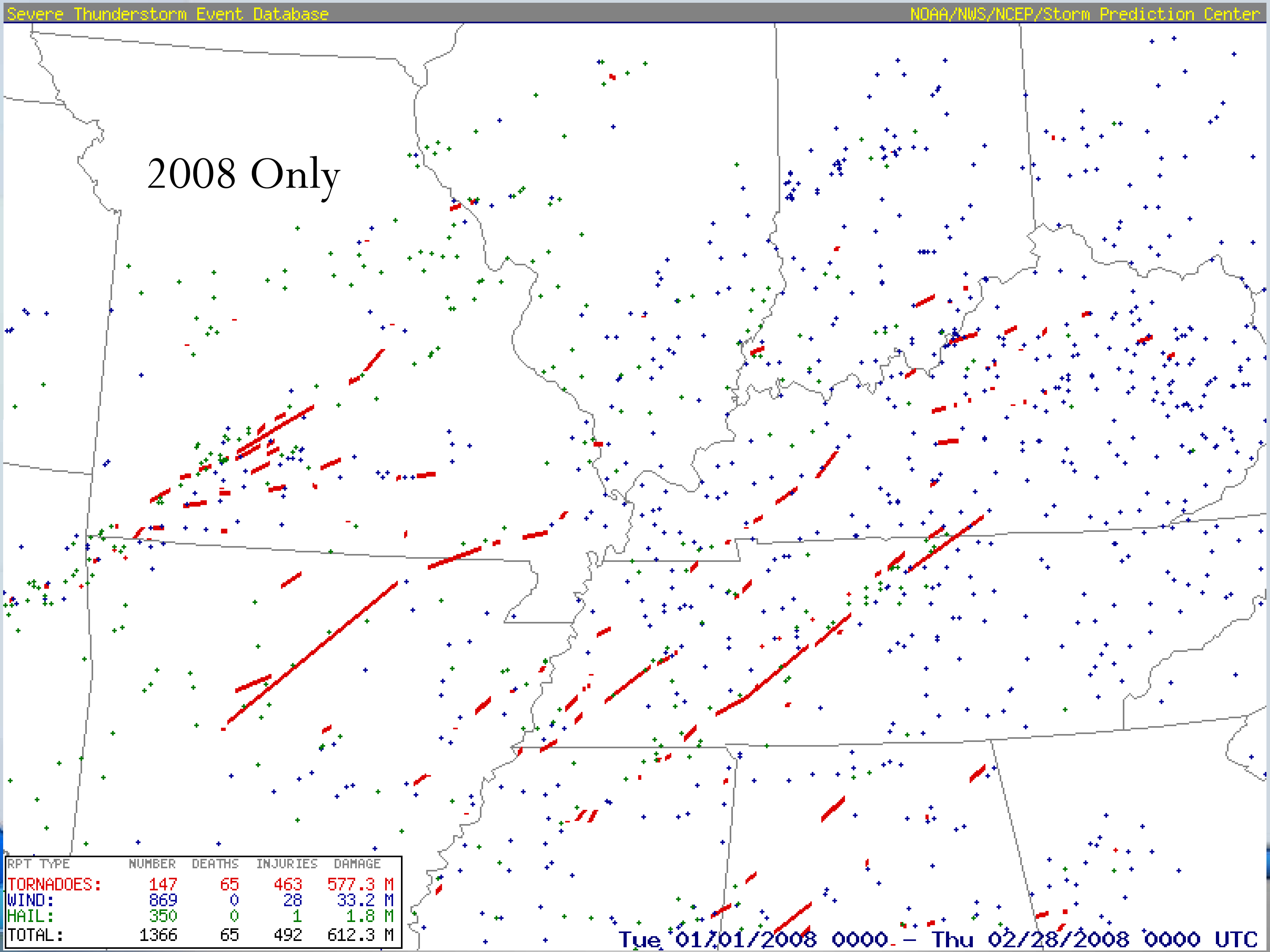
RPT TYPE	NUMBER	DEATHS	INJURIES	DAMAGE
TORNADOES:	7	0	9	2.7 M
WIND:	64	0	2	1.3 M
HAIL:	89	0	0	0.1 M
TOTAL:	160	0	11	4.1 M

•Jan – Feb Years Similar to 2010

8 Seasons corresponding to slide 13

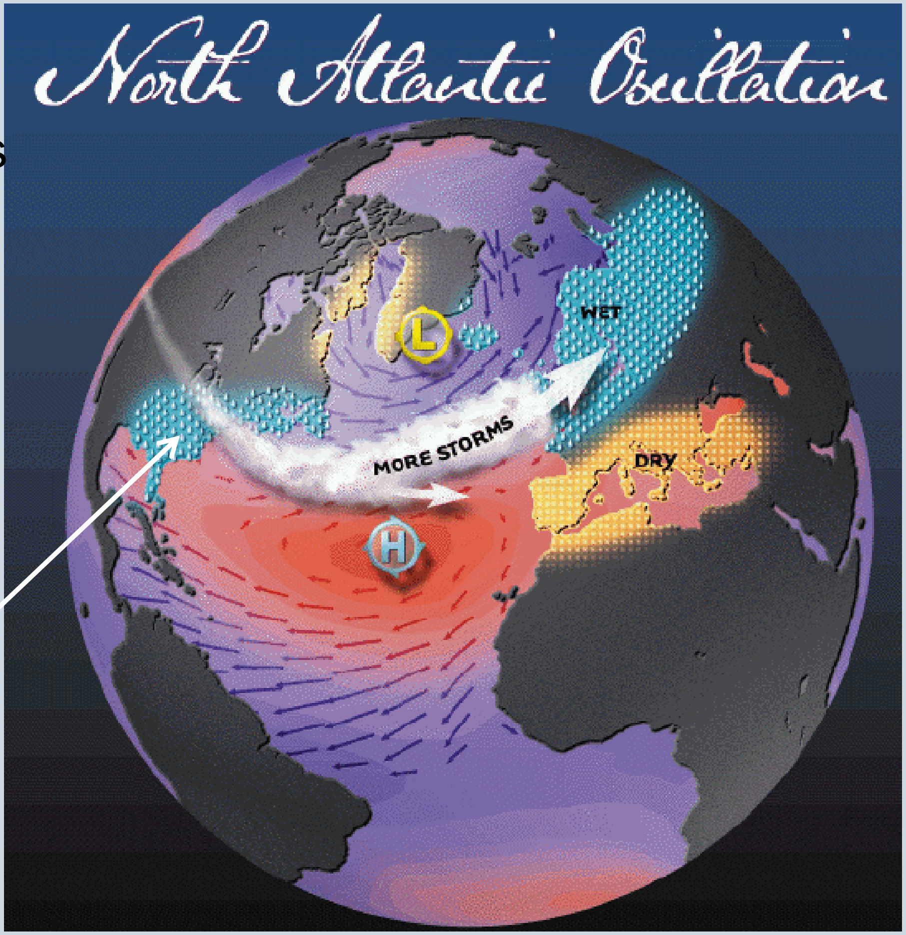


•Jan – Feb Years Similar to 2010



RPT TYPE	NUMBER	DEATHS	INJURIES	DAMAGE
TORNADOES:	147	65	463	577.3 M
WIND:	869	0	28	33.2 M
HAIL:	350	0	1	1.8 M
TOTAL:	1366	65	492	612.3 M

•The Fly in the Ointment



The Positive NAO index phase shows a stronger than usual subtropical high pressure center and a deeper than normal Icelandic low.

Results in more and stronger winter storms crossing the Atlantic Ocean on a more northerly track.

The eastern US experiences mild and wet winter conditions

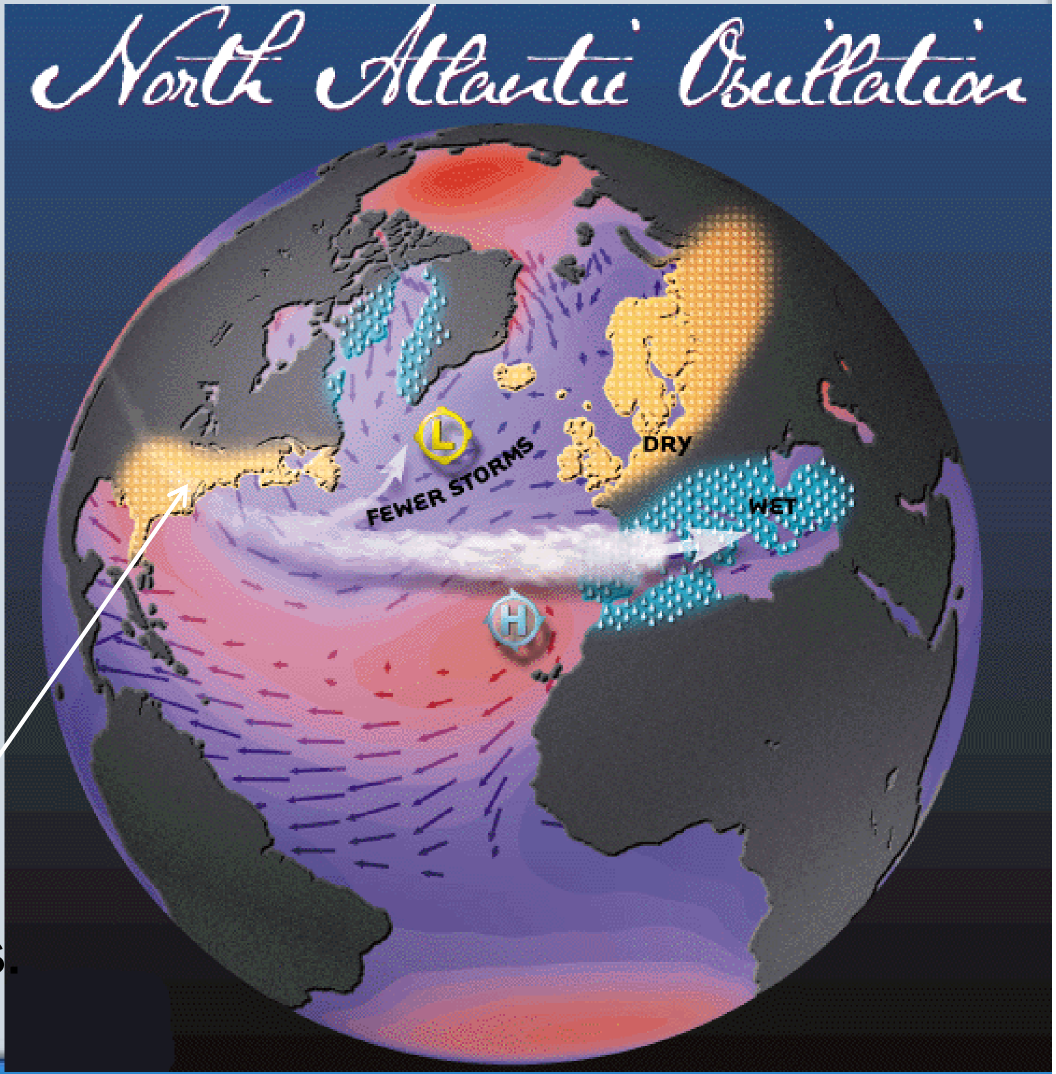
http://www.ldeo.columbia.edu/res/pi/NAO/

•Negative NAO

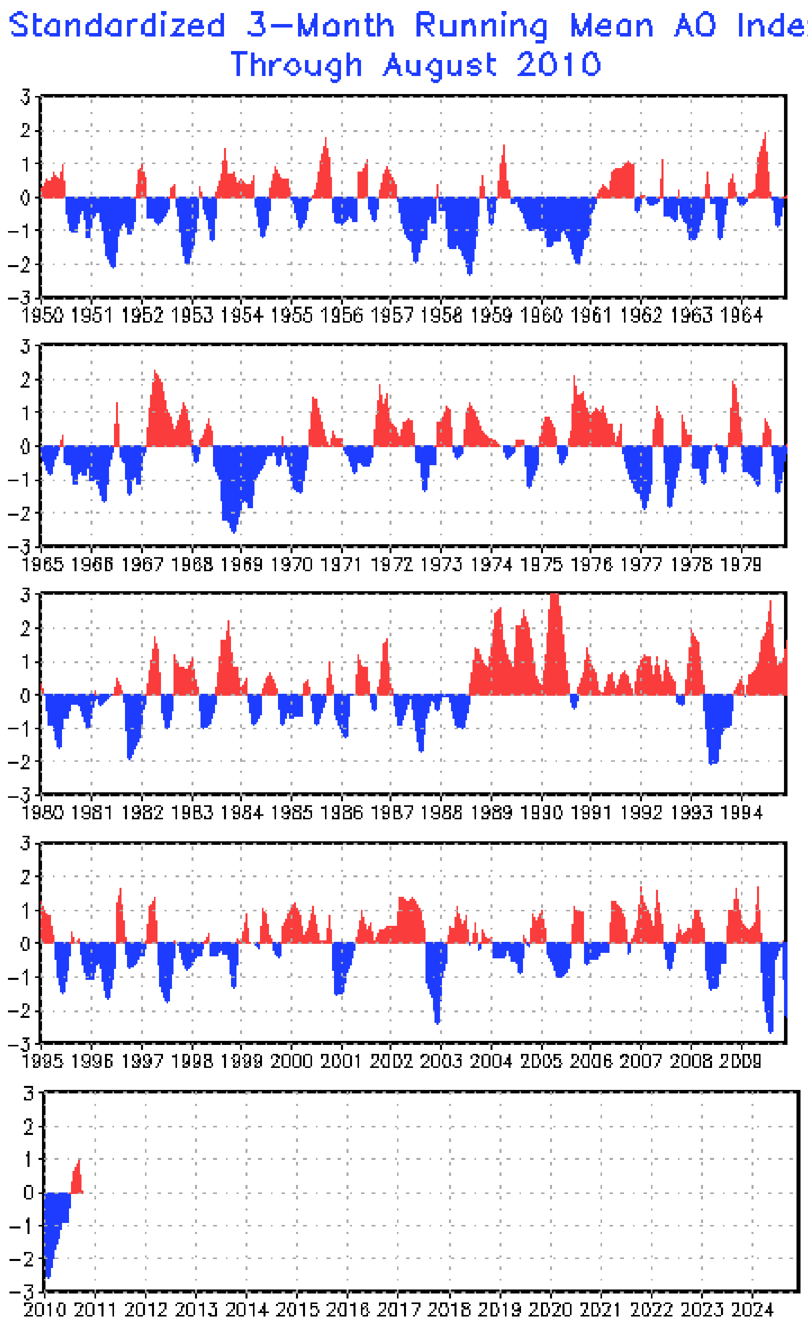
The negative NAO index phase shows a weak subtropical high and a weak Icelandic low.

Results in fewer and weaker winter storms crossing on a more west-east pathway.

The US east coast experiences more cold air outbreaks and hence snowy weather conditions.



http://www.ldeo.columbia.edu/res/pi/NAO/



No real skill in forecasting this.

Last year, we were in a negative phase with an El Nino. This resulted in us being on the north side of most storm systems with bouts of snow. Generally, a cold winter.

So, what will this winter be?

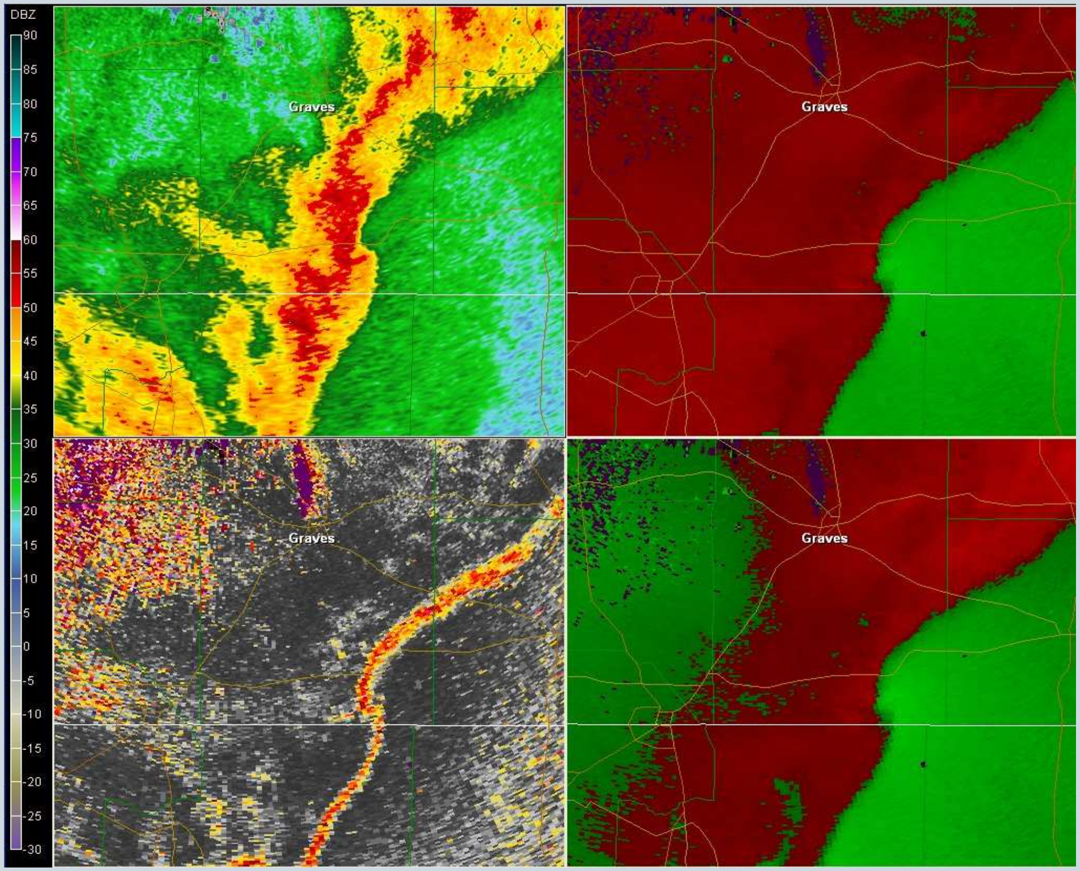
- If this follows previous patterns, prepare for possible severe weather (tornadoes, etc.)
- Snowfall varied from 3 to over 20 inches during the La Nina winters that were close to our current situation.

•A Quick Review of Cool Season QLCS's

- Low CAPE (0-1000 J/kg)
- CAPE = 36-780 J/kg
- (Normal spring values 2500 J/kg)
- LI's = -0.8 to -1.9
- Surface dew point $\geq$ 58 degrees
- High Shear (often unidirectional)
  - South to southwest in the lowest kilometer, then unidirectional above
  - (Less turning than in typical spring outbreaks)
  - 850 mb winds ~40-50 kts
  - Most of the shear is in the 0-1Km layer

- Use SW to locate kinks in line (reflectivity may not give you the details)
- SRM data – do not wait until you see gate-to-gate (moderate to strong meso)
- Britt & Glass 2006

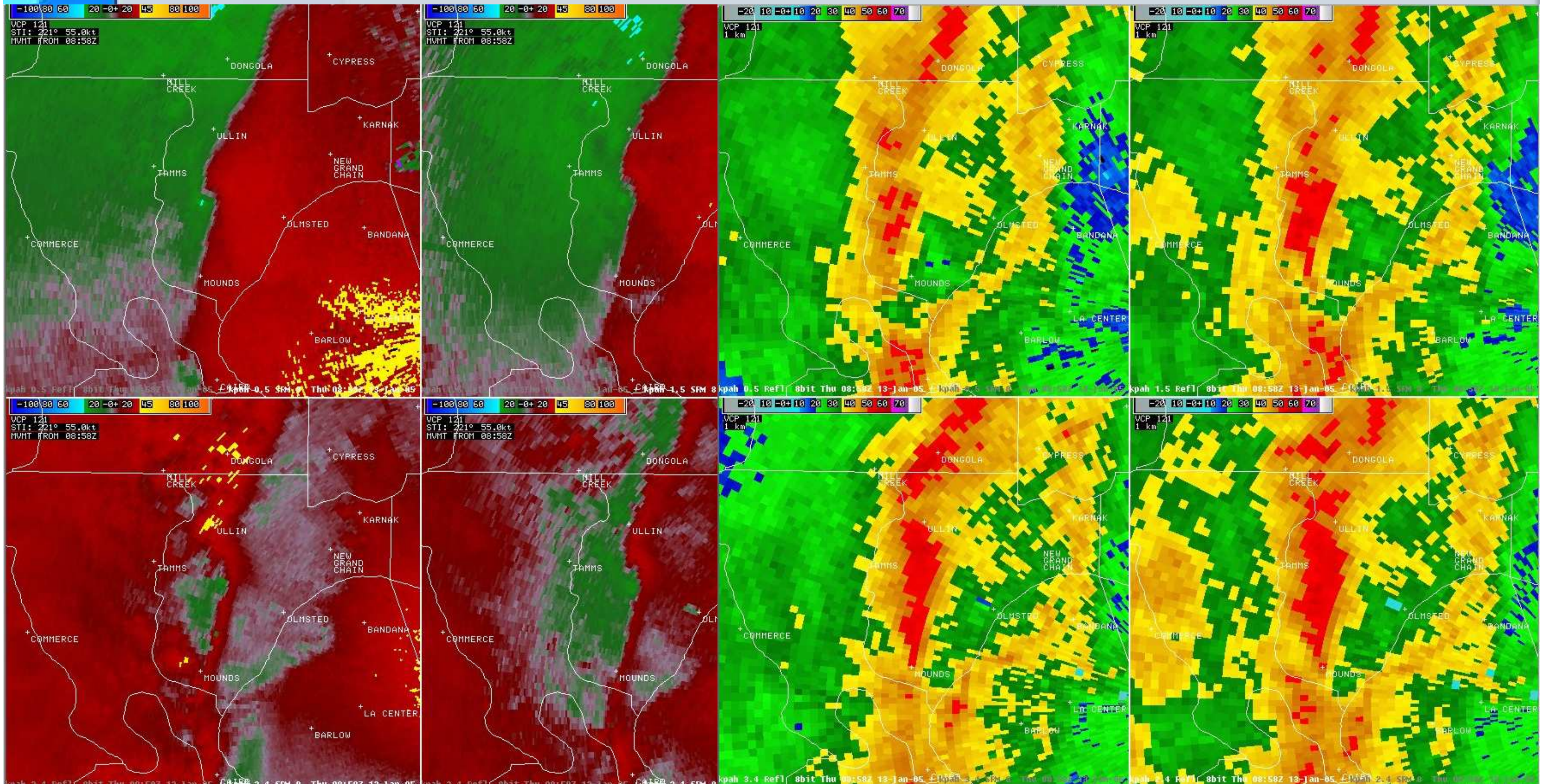
•04/04/08



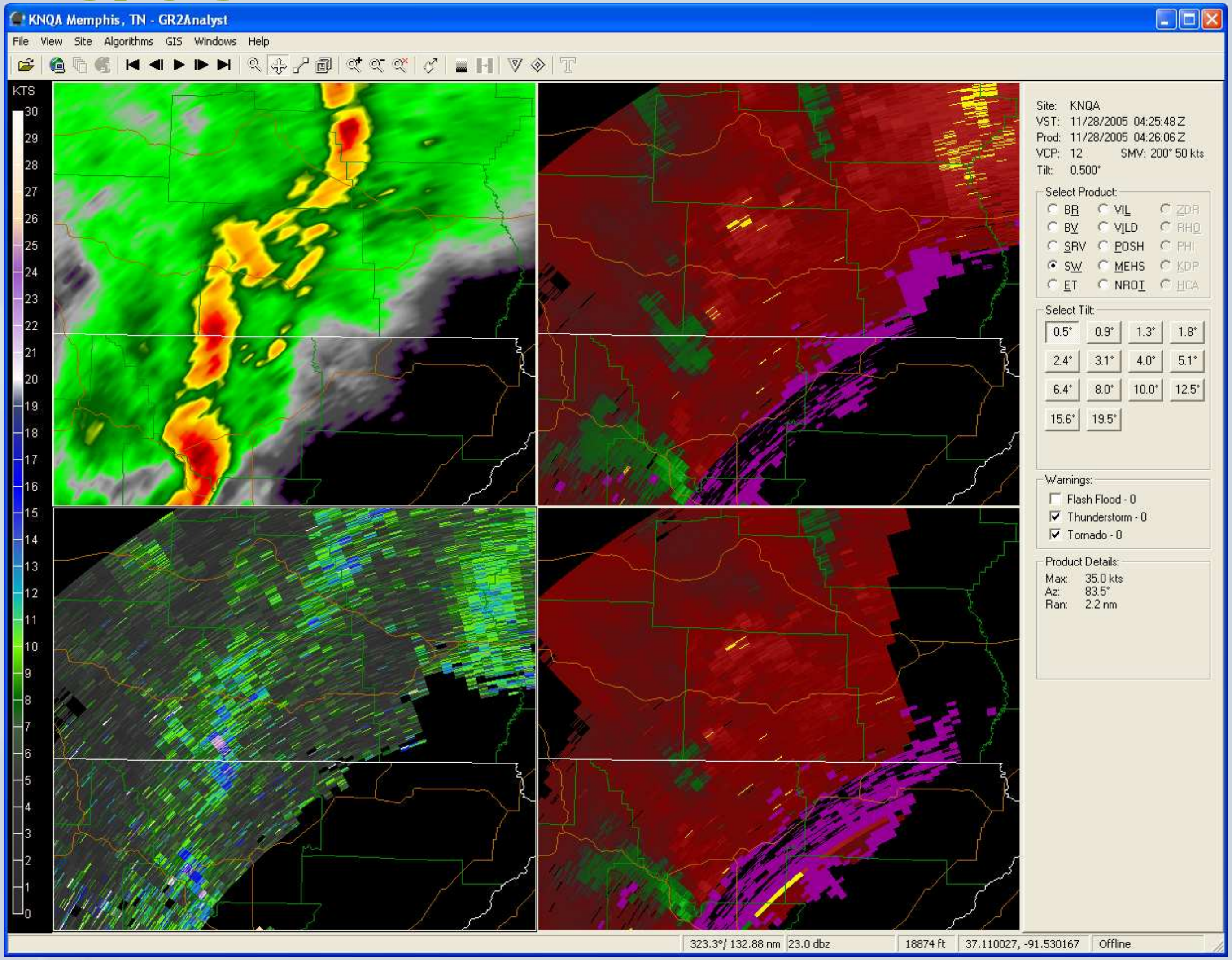
Note that the “kink” in the reflectivity data was farther north than what is seen in velocity or SW.

Tornado touchdown ~0620
EF1 Damage

•1/13/05


VCP 121
STI: 221° 55.0kt
MVMT FROM 08:58Z
DONGOLA
CYPRESS
MILL CREEK
KARNAK
ULLIN
TAMMS
NEW GRAND CHAIN
OLMSTED
BANDANA
COMMERCE
MOUNDS
BARLOW
LA CENTER

•11/28/05


KNQA Memphis, TN - GR2Analyst
File View Site Algorithms GIS Windows Help
KTS
Site: KNQA
VST: 11/28/2005 04:25:48 Z
Prod: 11/28/2005 04:26:06 Z
VCP: 12 SMV: 200° 50 kts
Tilt: 0.500°
Select Product:
BR VIL ZDR
BV VILD RHO
SRV POSH PHI
SW MEHS KDP
ET NROT HCA
Select Tilt:
0.5° 0.9° 1.3° 1.8°
2.4° 3.1° 4.0° 5.1°
6.4° 8.0° 10.0° 12.5°
15.6° 19.5°
Warnings:
Flash Flood - 0
Thunderstorm - 0
Tornado - 0
Product Details:
Max: 35.0 kts
Az: 83.5°
Ran: 2.2 nm
323.3°/ 132.88 nm 23.0 dbz
18874 ft
37.110027, -91.530167
Offline

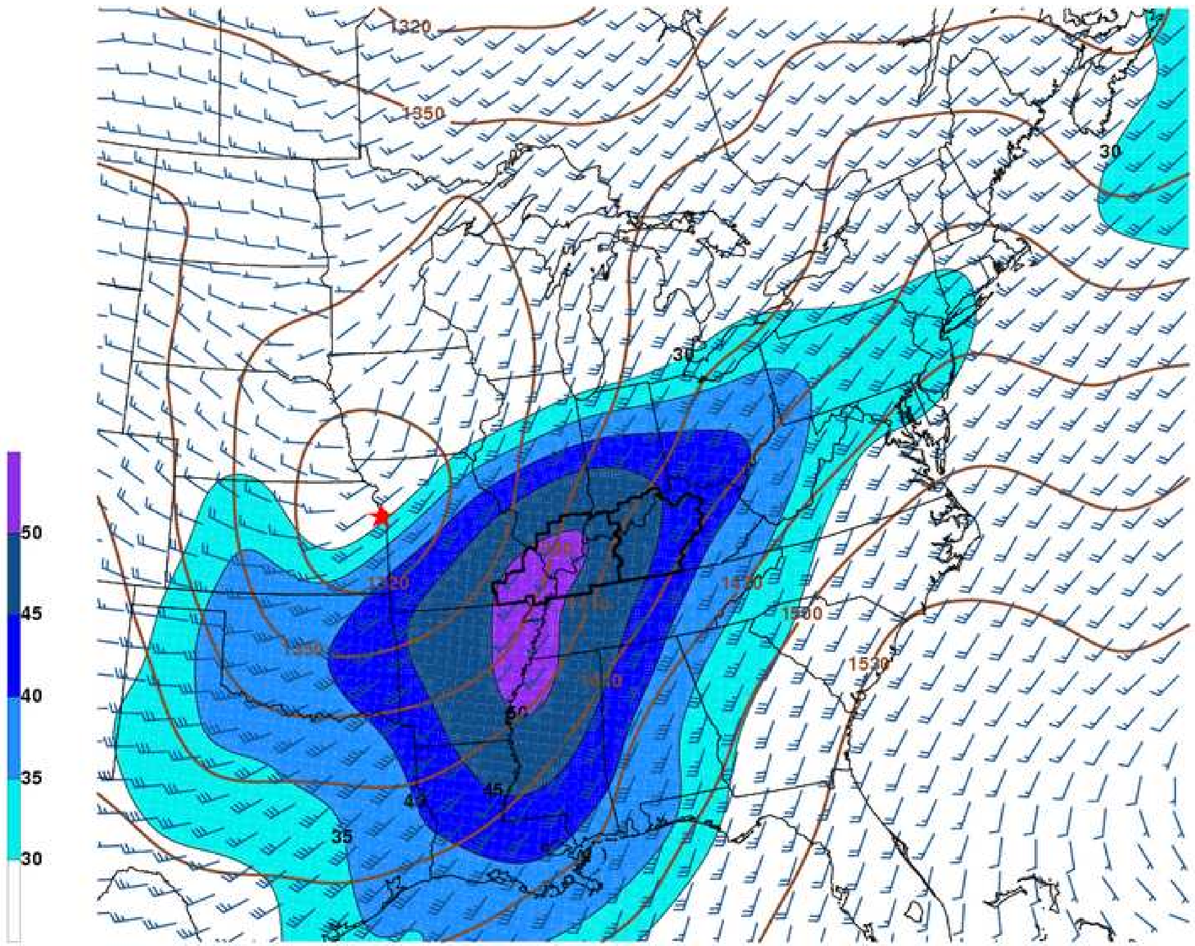
• Typical QLCS

- Line segments or broken line segments
- Kink develops in the line, or a small bow
  - Use SRM or SW to follow these formations
- Circulation develops on the leading edge of the bow or in the “kink”
  - Look for co-located high SW values (~20 kts)
- Tornado quickly develops

•Cool Season SVR Parameters

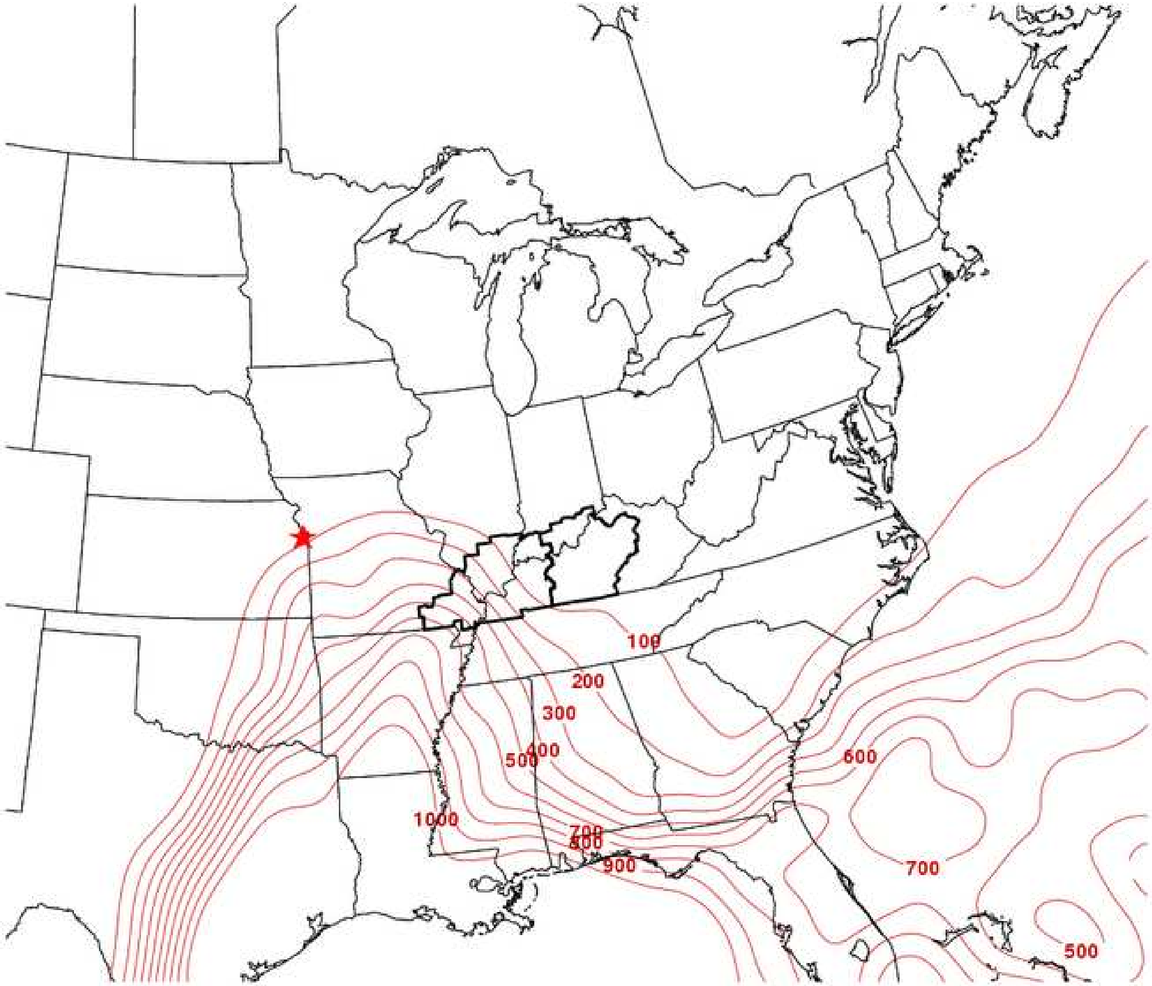
- **These values are average - from a 2008 study of PAH and LMK cool season svr wx events - Composite Analysis of Cool-Season Severe Weather Outbreaks in the Lower Ohio Valley Ruth L. Nahmensen, Theodore W. Funk, Patrick J. Spoden, Charles E. Graves, and Chad M. Gravelle**
- **Abundant mid-level and low-level shear**
  - **50 to 60 kts mid-level jet streak (500mb)**
  - **0-6 km shear magnitude ~50 kts**
  - **850 mb low-level jet ~40 kts**
  - **0-3 km SRH greater than 250 $m^2 s^{-2}$**
  - **0-1 km shear magnitude ~30 kts**
  - **Surface winds suggest strong 0-1 km SRH (SSE at t=-6h to S at t=0h; currently unavailable)**
- **Marginal CAPE nosing into the area of interest (300 J kg^{-1}).**
- **Anomalous moisture present at the surface (dewpoints about 50F) and through the troposphere (PWs in excess of 200% of normal).**

•25th and 75th Percentile Values @ T-6 hrs



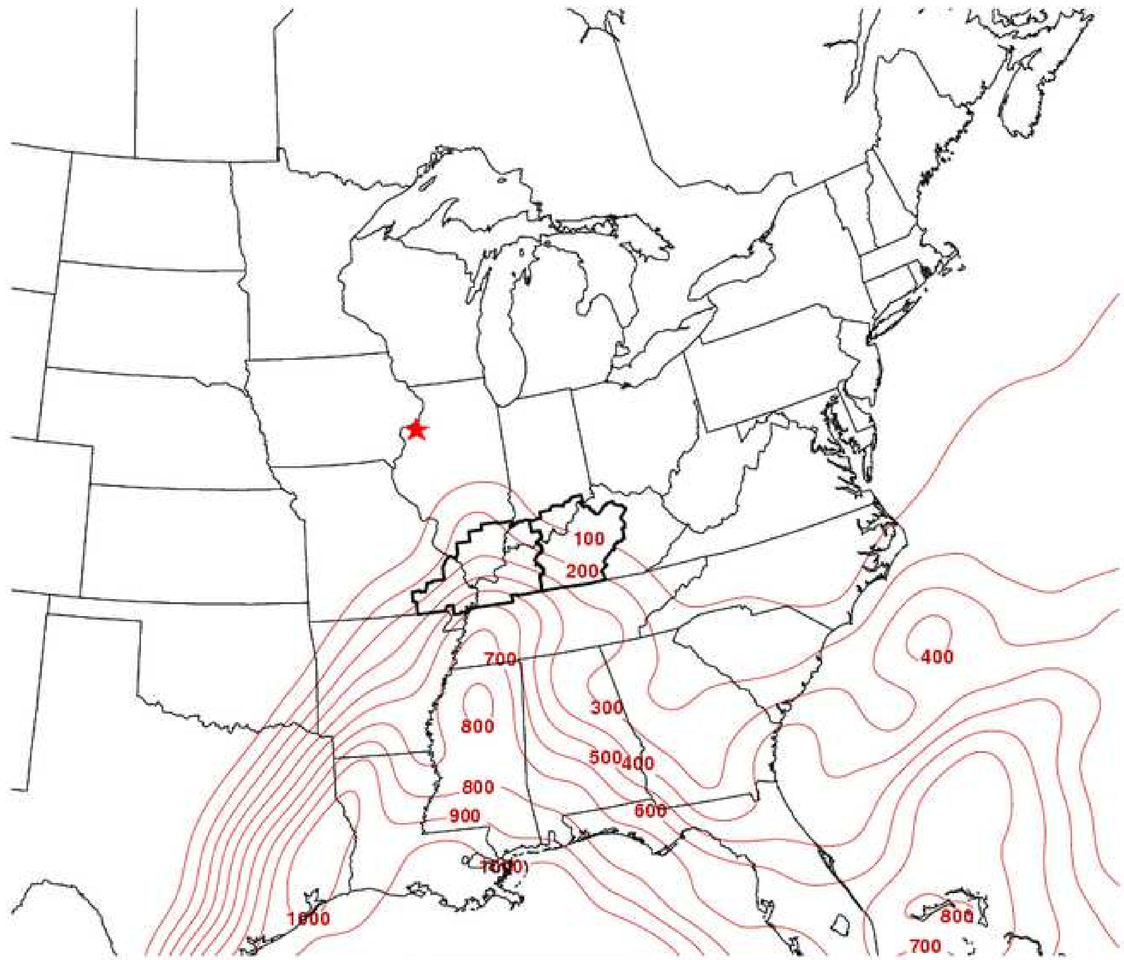
75TH PERCENTILE 850mb HGHT [m] and ISOTACHS [kts] at t=-6h

•25th and 75th Percentile Values @ T-6 hrs



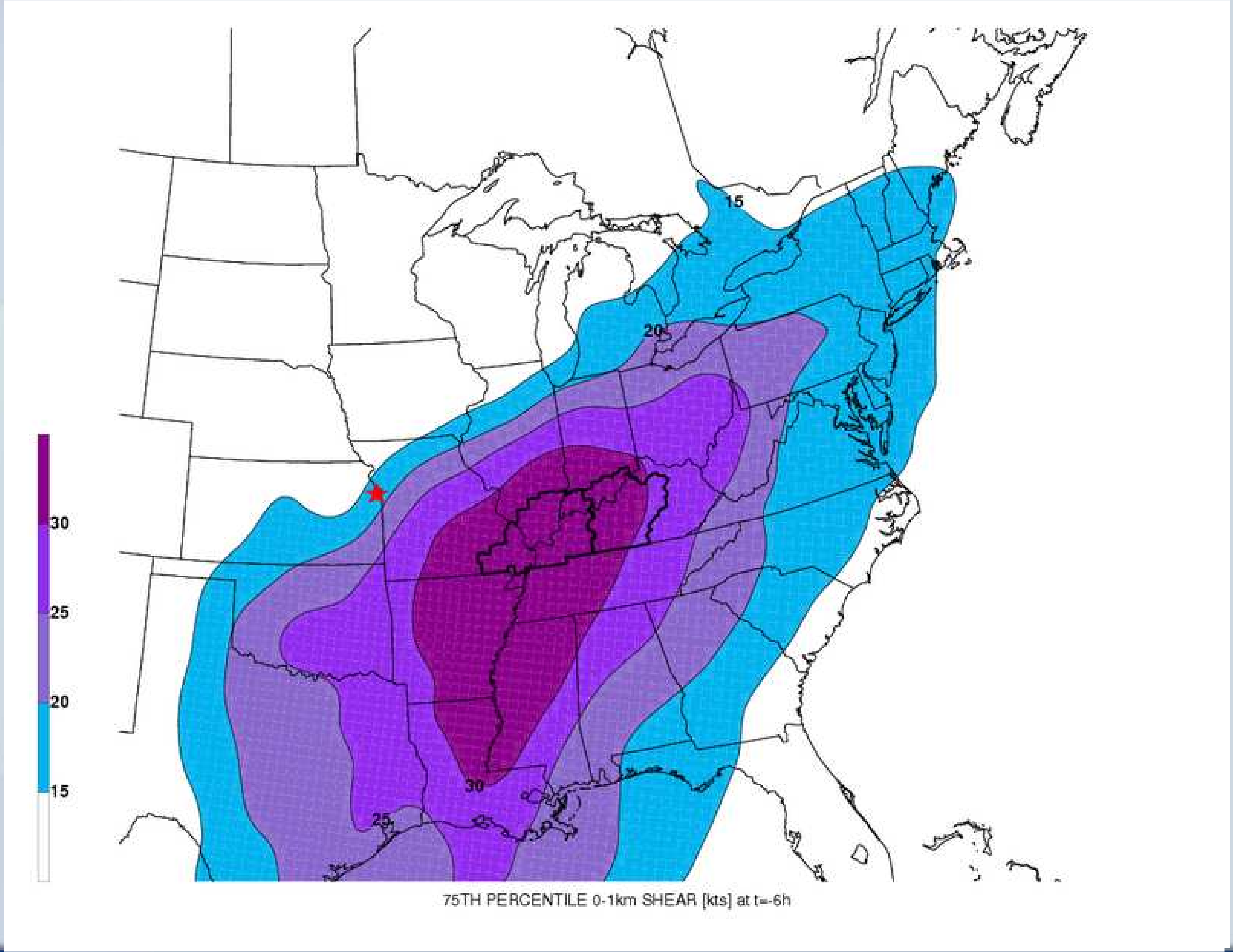
75TH PERCENTILE CAPE [J kg-1] at t=-6h

•25th and 75th Percential Values @ T-6 hrs

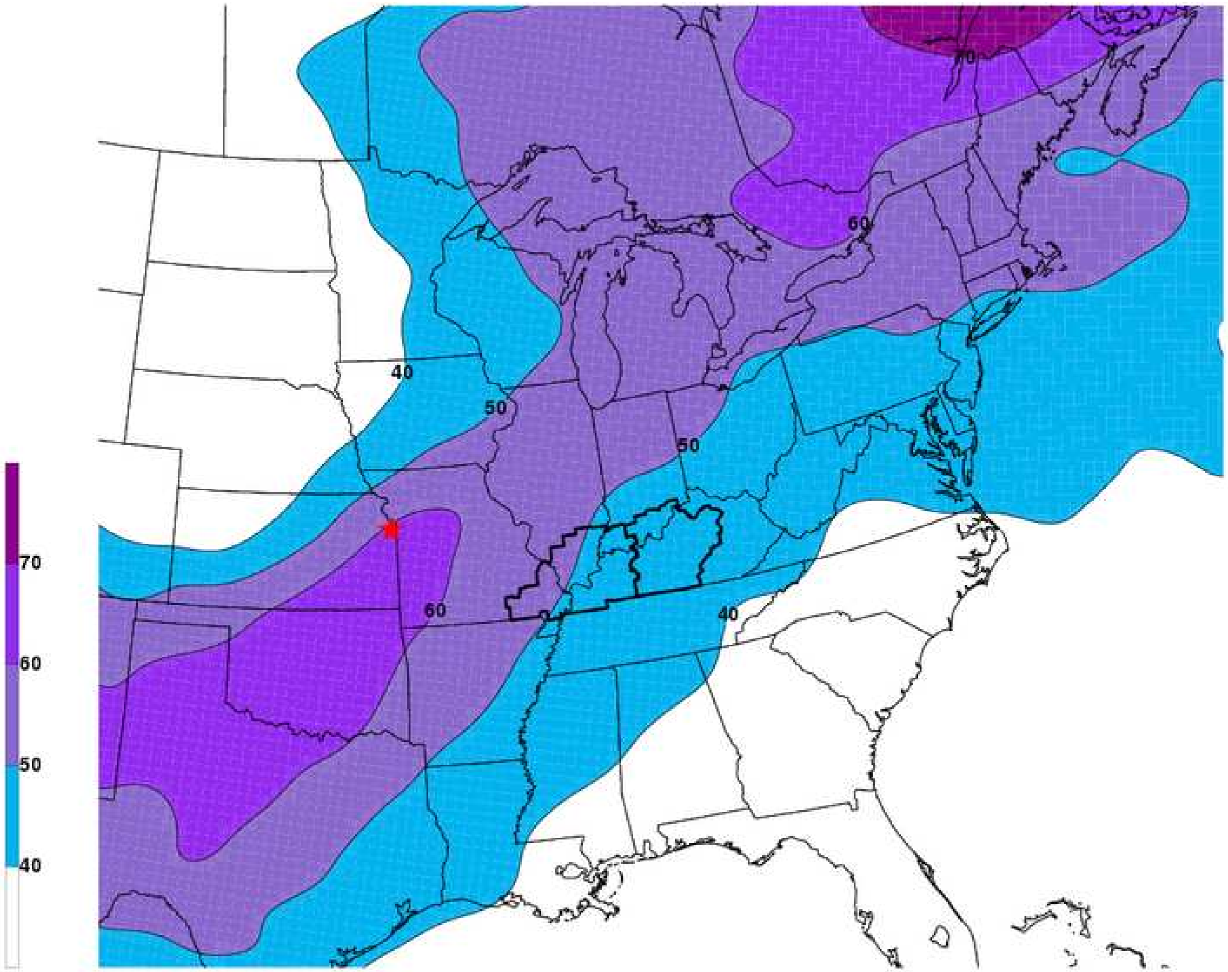


75TH PERCENTILE MUCAPE [J kg-1] at t=0h

•25th and 75th Percential Values @ T-6 hrs

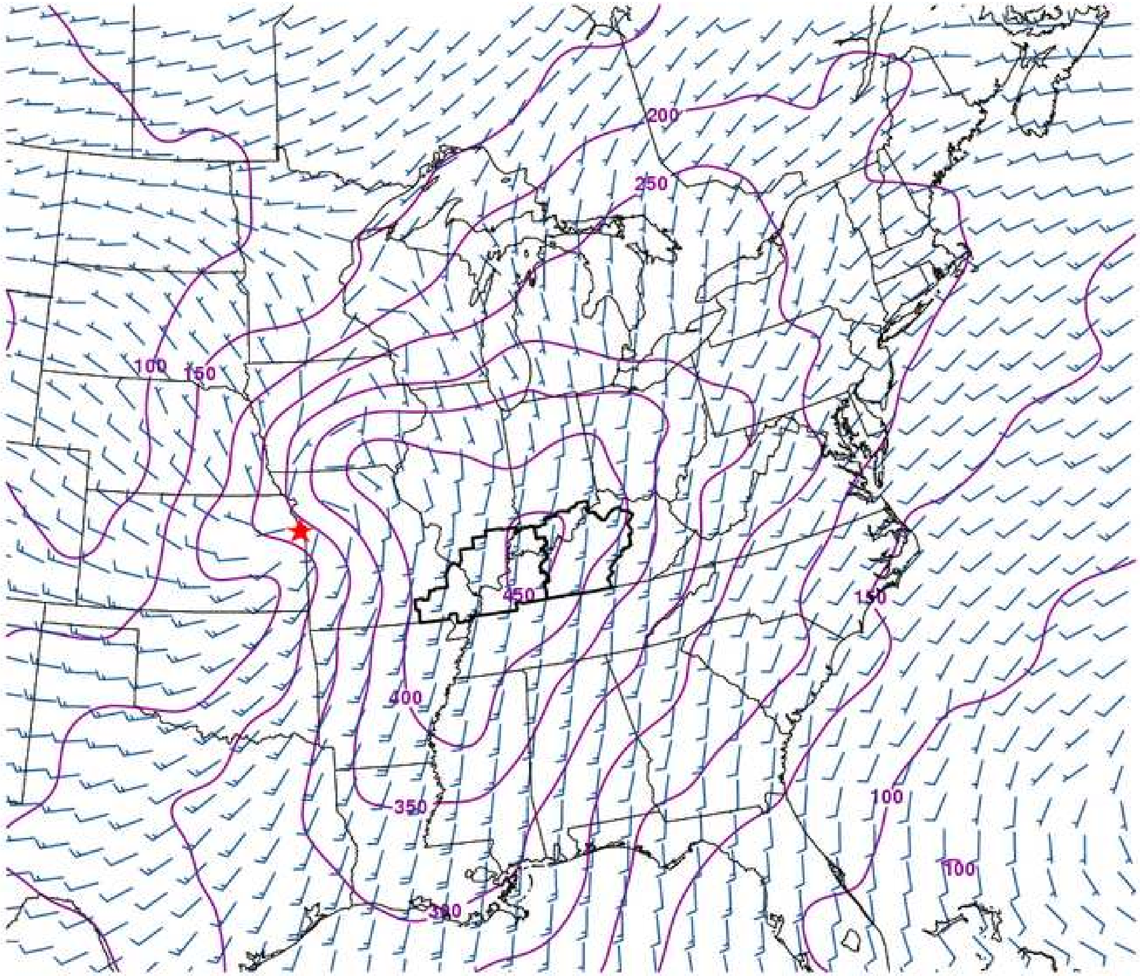


• 25^{th} and 75^{th} Percentile Values @ T-6 hrs



75TH PERCENTILE 0-6km SHEAR [kts] at t=-6h

- 25th and 75th Percentile Values @ T-6 hrs



75TH PERCENTILE 0-3km SRH [m2 s-2] and 10m WND [kts] at t=-6h

•Last Minute Notes

- **Severe Local Storms Conference:**
  - **Harold Brooks/NSSL summarized historical tornado fatalities noting that the decline in death rate has stopped, although the death rate from lightning continues to decline; most tornado deaths occur in mobile homes; *it appears that reducing deaths from tornadoes is becoming less of a non-meteorological problem and more of a response problem*.**
  - **Amanda Kis/OU provided an excellent overview of the current knowledge of nocturnal tornadoes and noted that *for significant tornadoes (EF2+) occurring at night that most (1) occur during the transition seasons and (2) result from QLCSs*. Shallow stable layers <500m are present along with high low-level shear, modest CAPE and stronger than typical LLJs. A similar study for the Great Plains by Corey Mead/SPC noted rapid and early LLJ formation, a strong surge of very moist air, and that tornadoes formed north-northeast of the LLJ core.**